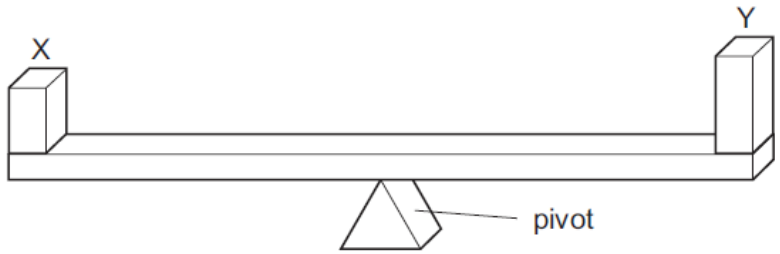
Forces and density

Choose one correct answer from A, B, C and D

1 Two blocks X and Y are placed on a beam as shown. The beam balances on a pivot at its centre.



What does this show about X and Y?

A They have the same mass and the same density.

B They have the same mass and the same weight.

C They have the same volume and the same density.

D They have the same volume and the same weight.

2 Two forces act on an object.

In which situation is it **impossible** for the object to be in equilibrium?

A The two forces act in the same direction.

B The two forces act through the same point.

C The two forces are of the same type.

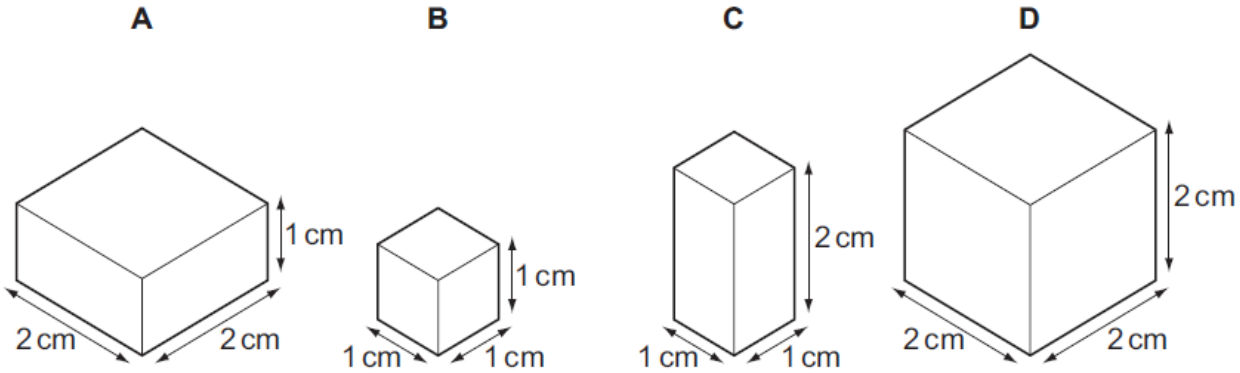
D The two forces are the same size.

3 Which of the following is a unit of density?

A cm^3/g **B** g/cm^2 **C** g/cm^3 **D** kg/m^2

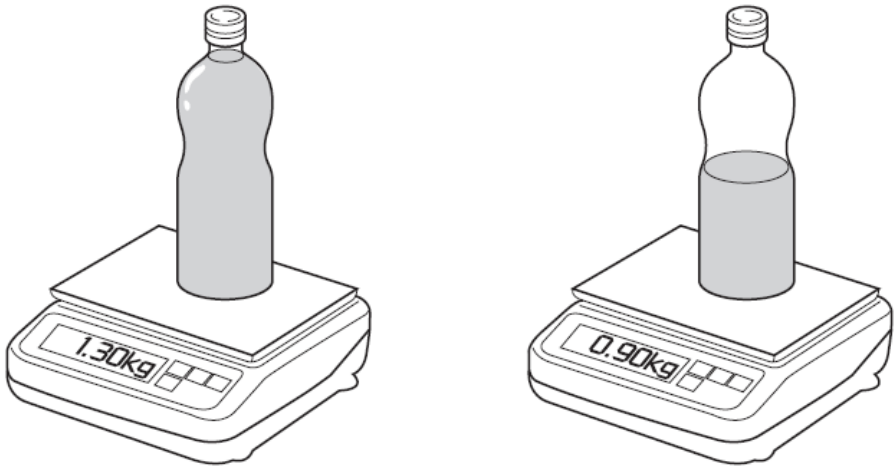
4 Each of the solids shown in the diagram has the same mass.

Which solid has the greatest density?



5 The mass of a full bottle of cooking oil is 1.30 kg.

When exactly half of the oil has been used, the mass of the bottle plus the remaining oil is 0.90 kg.



What is the mass of the empty bottle?

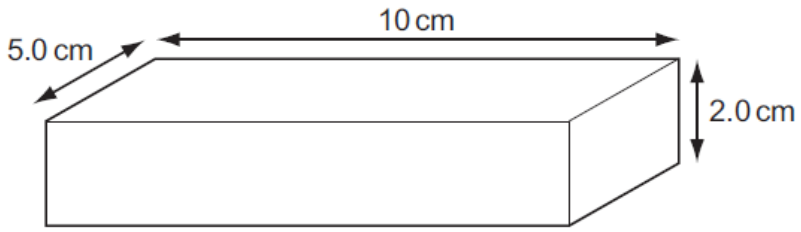
A 0.40 kg **B** 0.50 kg **C** 0.65 kg **D** 0.80 kg

6 The force of gravity acting on an astronaut in an orbiting spacecraft is less than when she is on the Earth's surface.

Compared with being on the Earth's surface, how do her mass and weight change when she goes into orbit?

	mass in orbit	weight in orbit
A	decreases	decreases
B	decreases	unchanged
C	unchanged	decreases
D	unchanged	unchanged

7 The diagram shows a rectangular metal block measuring 10 cm × 5.0 cm × 2.0 cm.



Its mass is 250 g.

What is the density of the metal?

A 0.20 g / cm^3 **B** 0.40 g / cm^3 **C** 2.5 g / cm^3 **D** 5.0 g / cm^3

8 Which items of apparatus are required to determine the density of a liquid?

A balance and measuring cylinder

B balance and thermometer

C metre rule and measuring cylinder

D metre rule and thermometer

9 Which property of an object **cannot** be changed by a force?

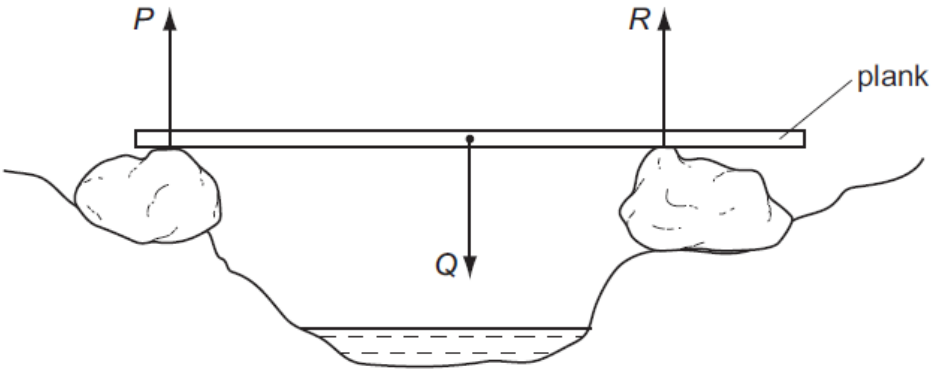
A its mass

B its motion

C its shape

D its size

10 A wooden plank rests in equilibrium on two boulders on opposite sides of a narrow stream. Three forces of size *P*, *Q* and *R* act on the plank.



How are the sizes of the forces related?

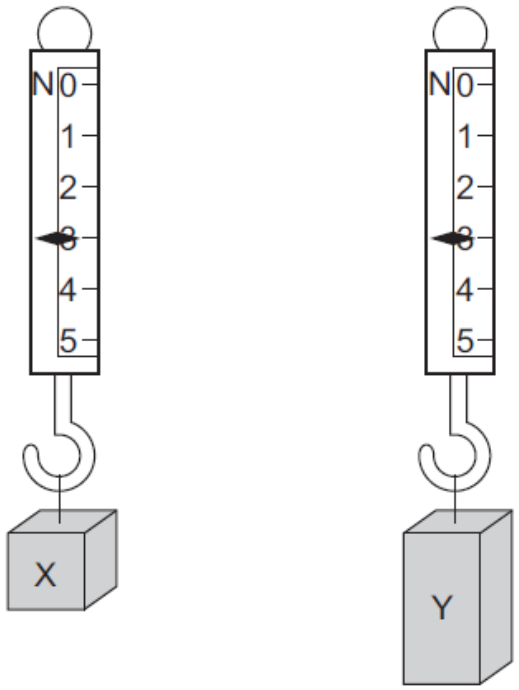
A $P + Q = R$

B $P + R = Q$

C $P = Q = R$

D $P = Q + R$

11 Two blocks of metal X and Y hang from spring balances as shown in the diagram.



What does the diagram show about X and Y?

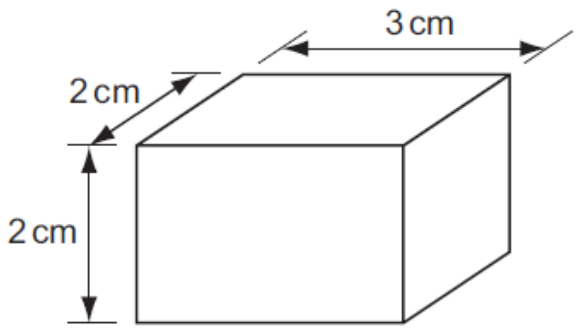
A They have the same mass and the same volume but different weights.

B They have the same mass and the same weight but different volumes.

C They have the same mass, the same volume and the same weight.

D They have the same weight and the same volume but different masses.

12 The diagram shows a rectangular block of density $2\,g/cm^3$.



What is the mass of the block?

A 2 g **B** 6 g **C** 14 g **D** 24 g

13 Which statement about mass and weight is correct?

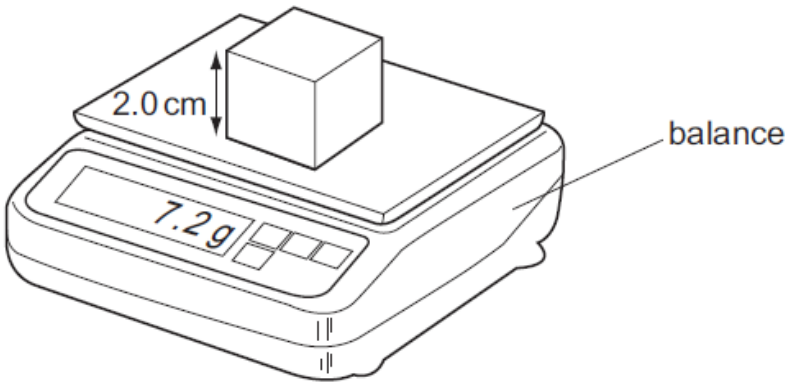
A Mass and weight are both forces.

B Neither mass nor weight is a force.

C Only mass is a force.

D Only weight is a force.

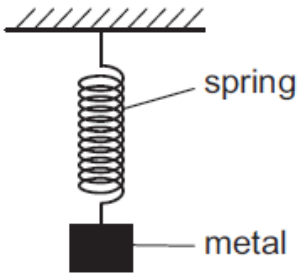
14 A cube of side 2.0 cm is placed on a balance.



What is the density of the cube?

A 0.90 g/cm^3 **B** 1.2 g/cm^3 **C** 1.8 g/cm^3 **D** 3.6 g/cm^3

15 A spring is stretched by hanging a piece of metal from it.



What is the name given to the force that stretches the spring?

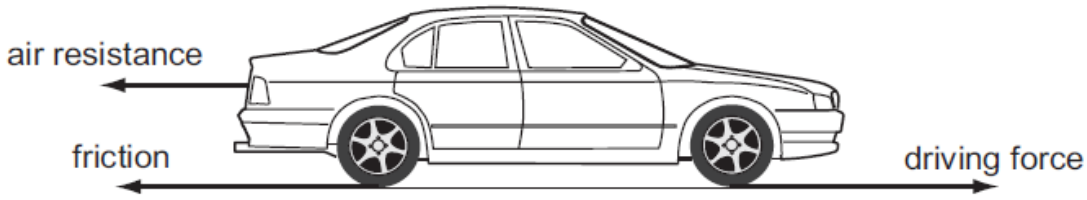
A friction

B mass

C pressure

D weight

16 Three horizontal forces act on a car that is moving along a straight, level road.

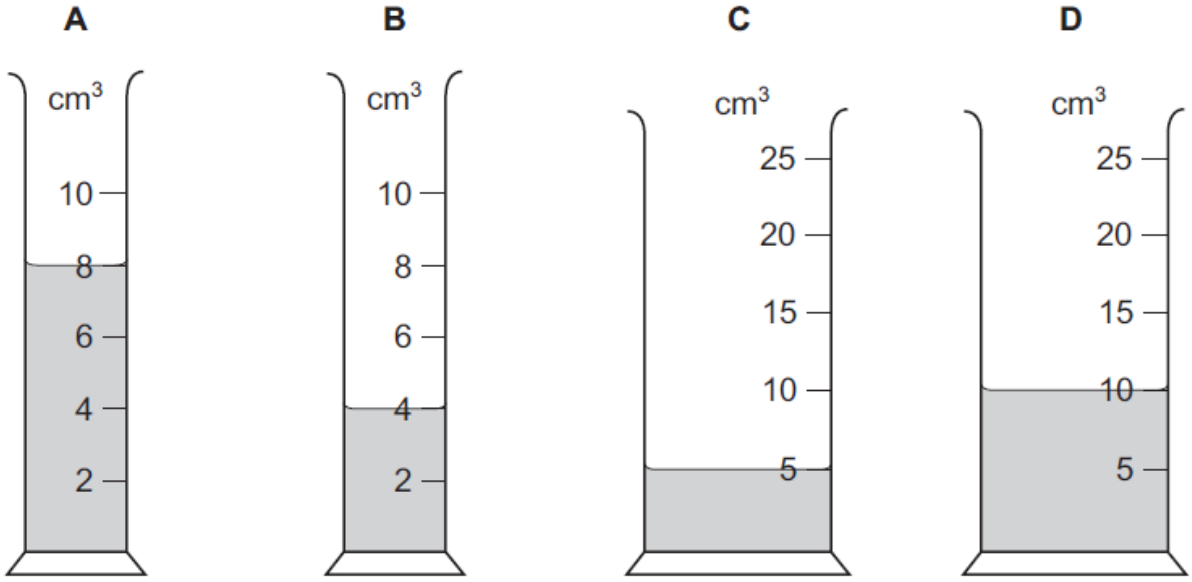


Which combination of forces would result in the car moving at constant speed?

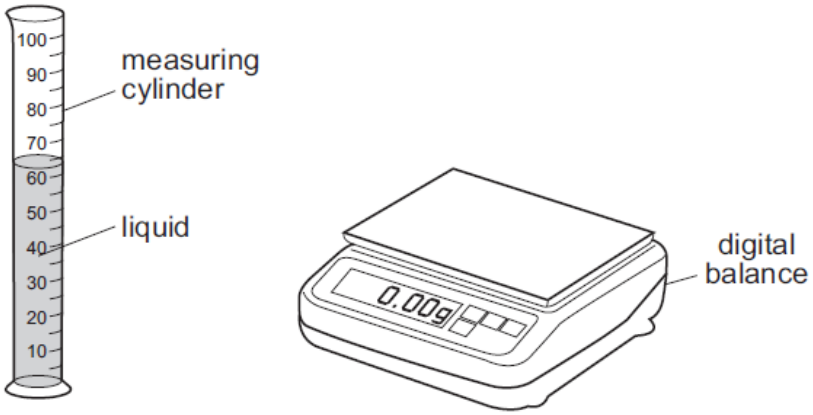
	air resistance	friction	driving force
A	200 N	1000 N	800 N
B	800 N	1000 N	200 N
C	800 N	200 N	1000 N
D	1000 N	200 N	800 N

17 The same mass of four different liquids is placed in some measuring cylinders.

Which measuring cylinder contains the liquid with the greatest density?



18 A student pours liquid into a measuring cylinder.



The student records the volume of the liquid from the scale on the measuring cylinder. He then puts the measuring cylinder containing the liquid on a balance and records the mass.

What else needs to be measured before the density of the liquid can be calculated?

A the depth of the liquid in the measuring cylinder

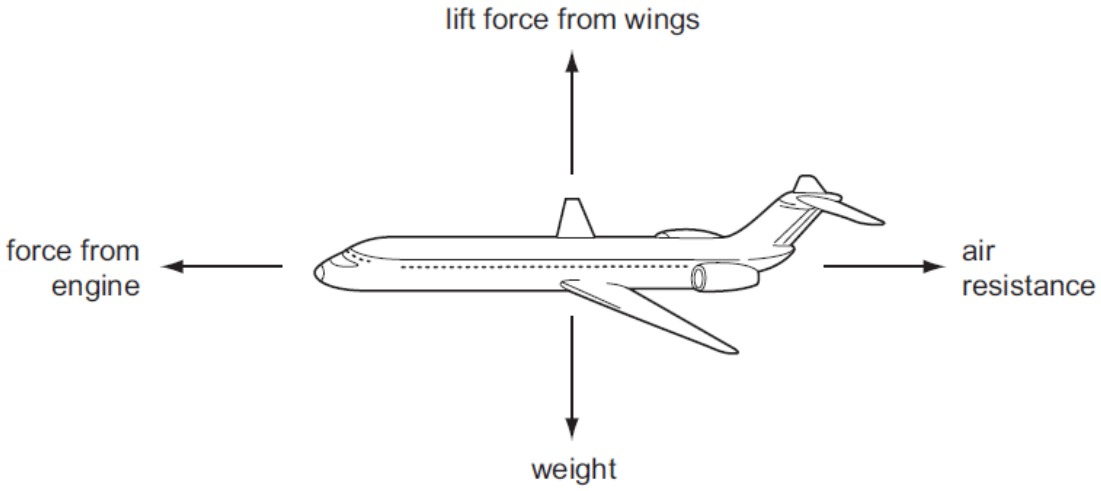
B the mass of the empty measuring cylinder

C the temperature of the liquid in the measuring cylinder

D the volume of the empty measuring cylinder

19 An aeroplane is in equilibrium.

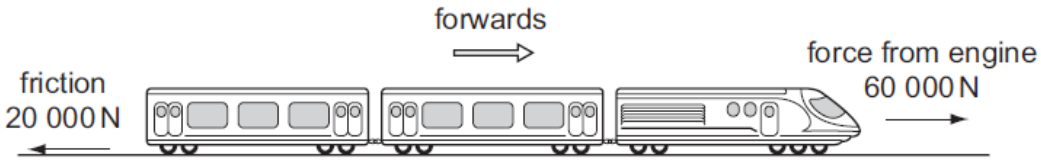
The diagram shows the forces acting on the aeroplane.



Which statement about the forces is correct?

	force from engine	lift force from wings
A	equal to air resistance	equal to weight
B	equal to air resistance	greater than weight
C	greater than air resistance	equal to weight
D	greater than air resistance	greater than weight

20 A train is travelling along a horizontal track at constant speed. Two of the forces acting on the train are shown in the diagram.



A force of air resistance is also acting on the train to give it a resultant force of zero.

What is this air resistance force?

A 40 000 N backwards

B 80 000 N backwards

C 40 000 N forwards

D 80 000 N forwards

21 Which property of a body can be measured in newtons?

A density

B mass

C volume

D weight

Answer the following questions

1 (a) Two horizontal strings are attached to a soft rubber ball, as shown in Fig. 2.1.

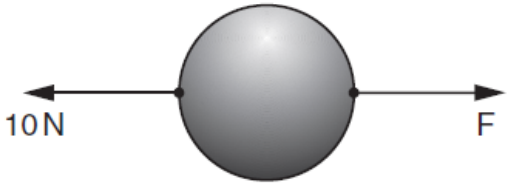


Fig. 2.1

A force of 10 N pulls on one string.

(i) The ball does not move. What is the value of the force F on the other string?

F = ... N

(ii) What change to the rubber ball do the two forces cause?

.....

[2]

(b) A garden pot containing soil weighs a total of 360 N. The pot rests on three equally-spaced blocks, so that surplus water can drain out of the holes in the base of the pot. The soil is uniformly distributed in the pot. The pot is shown in Fig. 2.2.

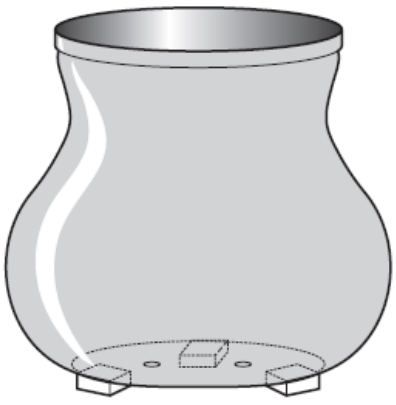


Fig. 2.2

(i) What is the force exerted by each block on the pot? .....N

(ii) State the direction of these forces.

.....

2 Fig. 3.1(a) shows a measuring cylinder, containing some water, on a balance.

Fig. 3.1(b) shows the same arrangement with a stone added to the water.

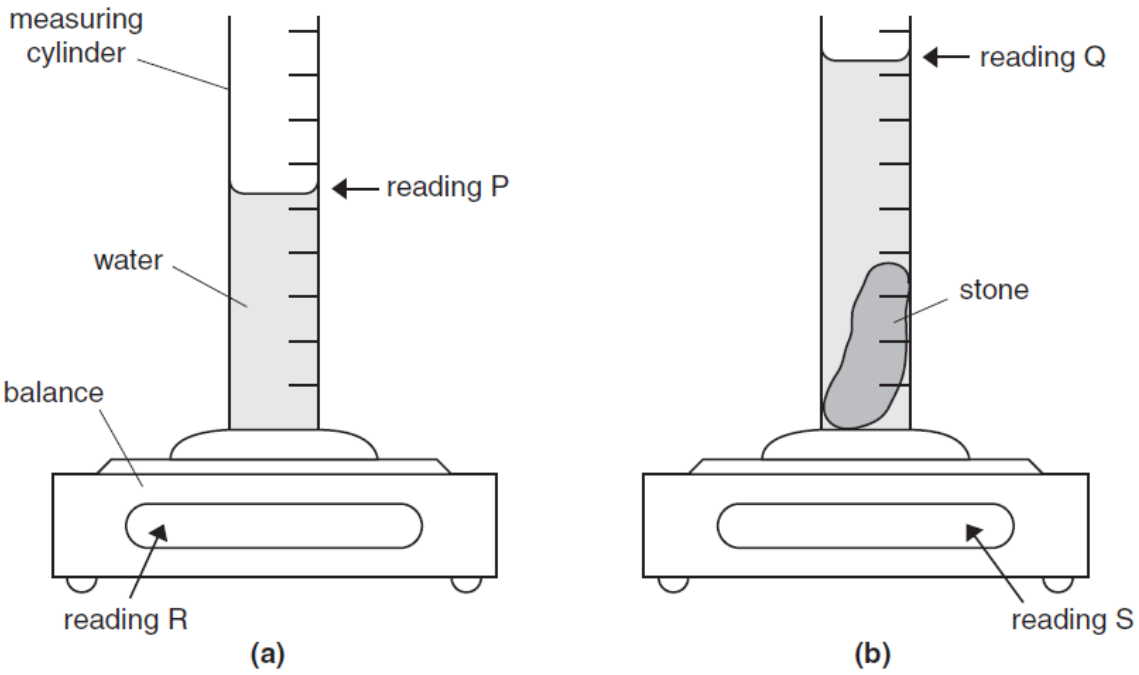


Fig. 3.1

(a) Which two readings should be subtracted to give the volume of the stone?

reading ..... and reading ..... [1]

(b) Which two readings should be subtracted to give the mass of the stone?

reading ..... and reading ..... [1]

(c) In a certain experiment,

mass of stone = 57.5 g,

volume of stone = 25 cm^3.

(i) Write down the equation linking density, mass and volume.

[1]

(ii) Calculate the density of the stone.

density of stone = ... [3]

3 (a) Fig. 2.1 shows a space probe, far out into space, where there is no atmosphere. It is moving at a constant speed in the direction shown by the arrow.

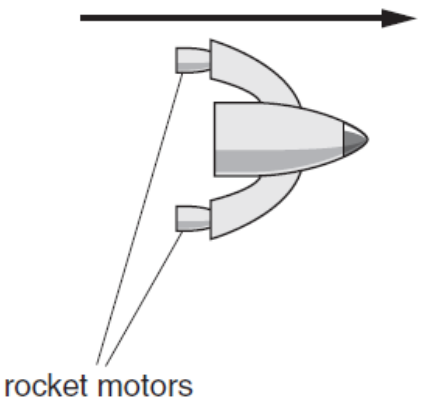


Fig. 2.1

Is a force necessary to keep the probe moving like this? Tick one box.

yes ☐

no ☐

If your answer is "yes", draw an arrow on the diagram to show this force. [1]

(b) Fig. 2.2 shows the space probe just after the rocket motors are fired.

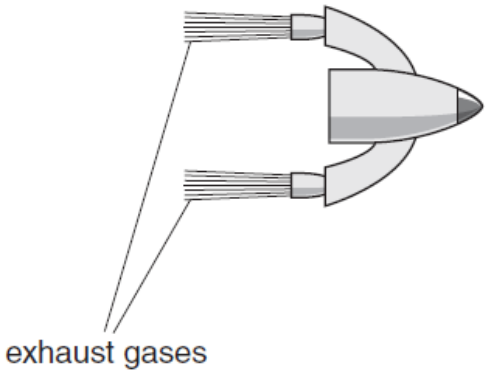


Fig. 2.2

State what effect this has on the space probe.

.....

..... [2]

(c) Later into its mission, the space probe is brought back into the Earth's atmosphere again, with no rockets working.

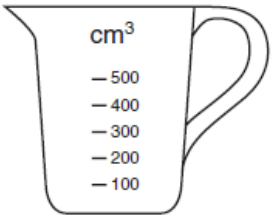
Suggest two effects that the atmosphere has on the space probe.

1. .....

2. ..... [2]

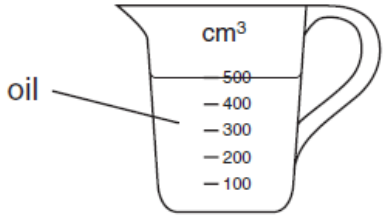
[Total: 5]

4 In an experiment to find the density of some oil, a student takes the following readings.



mass of empty measuring jug = 610 g

Fig. 4.1



mass of jug containing 500 cm^3 of oil = 1020 g

Fig. 4.2

(a) **(i)** Calculate the mass of oil in the jug.

mass of oil =..... g

(ii) Calculate the density of the oil.

density of oil =.....

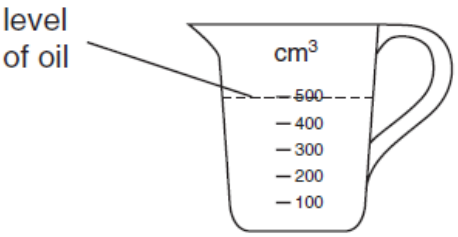
(iii) How could the volume of the oil be more accurately measured than with the measuring jug?

.....

[7]

(b) Water is more dense than oil.

On Fig. 4.3, mark approximately where the surface of the same mass of water would be if it replaced the oil. [1]



5 Some fat purchased from a shop is supplied as the block shown in Fig. 10.1.

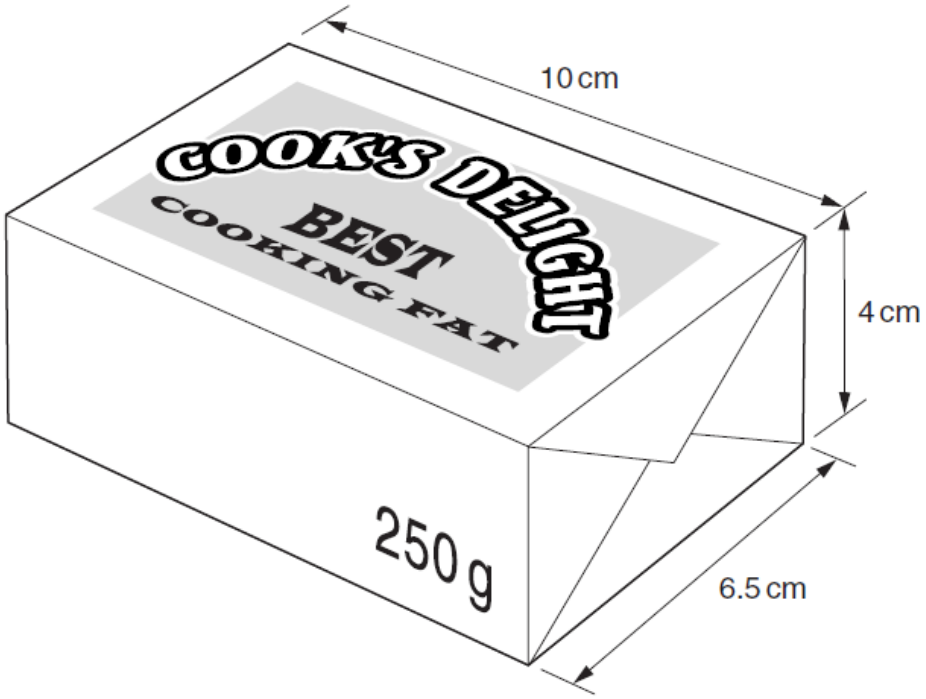


Fig. 10.1

Use the information in Fig. 10.1 to calculate

(a) the volume of the block,

volume = ... cm^3 [2]

(b) the density of the fat. Give your answer to 2 significant figures.

density = ... [5]